

In the Drawings:

A Replacement Sheet is submitted herewith, in which FIG. 6 has been amended to change “D₂” to “D₃”.

REMARKS

(1) Applicant amends the specification herein to correct typographical errors and to overcome objections noted in the Office Action. No new subject matter has been added by these amendments to the specification.

(2) Claims 40-67 are pending in the present application. Applicant cancelled claims 1-39 herein. Applicant added new claims 40-67 herein, but no new matter has been added.

(3) The Office Action cited the following references:

A. U. S. Patent 6,242,138 B1, by Mitsui, *et al.*, entitled *Phase Shift Mask And Phase Shift Mask Blank* (referred to as “Mitsui” hereinafter);

B. U. S. Patent 6,274,281 B1, by Chen, entitled *Using Different Transmittance With Attenuate Phase Shift Mask (APSM) To Compensate ADI Critical Dimension Proximity* (referred to as “Chen” hereinafter);

C. U. S. Publication 2002/0122991 A1, by Shiota, *et al.*, entitled *Halftone Phase Shift Mask And Mask Blank* (referred to as “Shiota” hereinafter); and

D. U. S. Patent 6,508,949 B1, by Takushima, entitled *Method For Correcting Characteristics Of Attenuated Phase-Shift Mask* (referred to as “Takushima” hereinafter).

(4) Claims 1-39 were objected to for informalities. Applicant cancelled Claims 1-39 herein.

(5) Claim 6 was rejected under 35 U.S.C. § 112, first paragraph. Claims 13-28 were rejected under 35 U.S.C. § 112, second paragraph. Applicant cancelled Claims 6 and 13-28 herein.

(6) Claims 1, 5-11, and 35-39 were rejected under 35 U.S.C. § 103(a) as assertedly being unpatentable over Mitsui. Claims 2, 13-20, 23, 26, and 29-34 were rejected under 35 U.S.C. § 103(a) as assertedly being unpatentable over Mitsui in view of Takushima. Claims 3, 21-22, 24-25, and 27 were rejected under 35 U.S.C. § 103(a) as assertedly being unpatentable over Mitsui in view of Takushima and further in view of Shiota. Claim 4 was rejected under 35 U.S.C. § 103(a) as assertedly being unpatentable over Mitsui in view of Chen. Claim 12 was

rejected under 35 U.S.C. § 103(a) as assertedly being unpatentable over Mitsui in view of Shiota. Applicant cancelled Claims 1-39 herein.

(7) Applicant added new Claims 40-67 herein. Applicant respectfully asserts that Claims 40-67 are patentable and non-obvious in view of the prior art cited in the Office Action based on the following.

Regarding obviousness, MPEP 2143 (8th ed., rev. 3, Aug. 2005) states:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

With respect to the third criterion, *all* the claim limitations must be taught or suggested by the prior art.

Claims 40-52

The cited references do not disclose, teach, suggest, or motivate a “method of making an attenuating and phase-shifting mask for use in semiconductor manufacturing” beginning with “obtaining a mask blank designed for use with light of a first wavelength” and then “patterning and adapting the mask blank to be an adapted-patterned mask for use with light of a second wavelength” by “reducing the initial APS-layer thickness of the APS layer to a first APS-layer thickness at the dark areas, and patterning and etching the APS layer to form the clear areas, wherein the APS layer remains with a second APS-layer thickness at the clear areas, [with] the second APS-layer thickness being smaller than the first APS-layer thickness” so that “a predetermined transmittance and a predetermined phase shift are provided by light of the second wavelength passing through dark areas of the adapted patterned mask relative to light of the second wavelength passing through clear areas of the adapted-patterned mask,” where “the second wavelength is smaller than the first wavelength,” as Claim 40 requires.

The Office Action cites Mitsui. However, the Office Action states (and Applicant agrees) that “Mitsui et al. do not specifically teach thinning of the attenuated PS layer on the

attenuated PSM blank for a first wavelength of exposure light to adapt the blank for making an attenuated PSM usable at a second wavelength of exposure light that is different from the first wavelength.” Furthermore, the Office Action states (and again Applicant agrees) that “Mitsui et al. do not specifically teach that a part of the attenuating PS layer with a second thickness remains at the clear areas of the attenuated PSM, wherein the second thickness is less than the previous first thickness of this layer.” Thus, Applicant respectfully asserts that the invention of Claim 40 is not obvious in view of Mitsui.

The Office Action cites Chen in combination with Mitsui. Chen is focused on patterning and etching a mask blank designed for a first wavelength for use with the *same* first wavelength, nothing about *adapting* it for use with a *different*, second wavelength. Neither Mitsui or Chen teach, disclose, or suggest a *method* of taking a mask blank designed for use with light of a first wavelength, modifying the thicknesses of the attenuating and phase-shifting layer at the dark and clear areas *to adapt the same mask blank* for use with light of a second wavelength (where the second wavelength is smaller than the first wavelength). Thus, Applicant respectfully asserts that the invention of Claim 40 is not obvious in view of Mitsui or Chen, either alone or in combination.

The Office Action also cites Takushima and Shiota, but these references are clearly not relevant to Claim 40. Neither Takushima or Shiota teach “patterning and etching the APS layer to form the clear areas, wherein the APS layer remains with a second APS-layer thickness at the clear areas,” as Claim 40 requires. Thus, Applicant respectfully submits that the invention of Claim 40 is not obvious in view of Takushima or Shiota, alone or in combination with the other cited references.

Each and every element of the claim must be taught or suggested in the cited references to build a proper *prima facie* case of obviousness. No element or limitation of the claim can be ignored when establishing a *prima facie* case of obviousness (see MPEP 2143 above). Therefore, Applicant respectfully asserts that the invention of Claim 40 is not obvious in view of the cited references.

Because Claims 41-52 depend from Claim 40, Applicant respectfully submits that Claims 41-52 are patentable over the cited references because of their dependency from independent claim 40 for at least the same reasons discussed above regarding Claim 40.

Claim 53

Applicant respectfully submits that the same arguments presented above for Claim 40 also apply for Claim 53. Furthermore, the cited references do not teach, disclose, or suggest the additional limitations that the “mask blank is prefabricated and obtained from another company,” “the second wavelength is at least 30 nm smaller than the first wavelength,” and “determining the first and second APS-layer thicknesses for providing the predetermined transmittance and the predetermined phase shift by using the equations” stated in Claim 53. Thus, Applicant respectfully asserts that the invention of Claim 53 is not obvious in view of the cited references.

Claims 54-65

The cited references do not disclose, teach, suggest, or motivate a “method of making an attenuating and phase-shifting mask for use in semiconductor manufacturing” beginning with “obtaining a mask blank designed for use with light of a first wavelength” and then “patterning and adapting the mask blank to be an adapted-patterned mask for use with light of a second wavelength” by “reducing the initial APS-layer thickness of the APS layer to a first APS-layer thickness” and by “recessing the transparent layer by a recess depth in the clear areas” so that “a predetermined transmittance and a predetermined phase shift are provided by light of the second wavelength passing through dark areas of the adapted-patterned mask relative to light of the second wavelength passing through clear areas of the adapted-patterned mask” where “the second wavelength is smaller than the first wavelength” and by “determining the first APS-layer thickness and the recess depth to provide the predetermined transmittance and the predetermined phase shift by using the equations $\Phi_t = [2(n_t-1) D_1/\lambda_t]180^\circ + [2(n_c-1) D_2/\lambda_t]180^\circ$, $T_t = A_t \exp(-4\pi D_1 k_t/\lambda_t)$, $D_1 = -\lambda_t \ln[T_o/A_t]/4\pi k_t$, $D_2 = \lambda_t [1 - 2(n_t-1) D_1/\lambda_t]/[2(n_c-1)]$,” as Claim 54 requires.

The Office Action cites Mitsui, alone and in combination with Takushima. The Office Action states (and Applicant agrees) that “Mitsui et al. do not specifically teach removing

portions of the transparent substrate to form a recess at the clear areas or portions having a first recess depth.” Thus, Mitsui is clearly missing a teaching on the element of “recessing the transparent layer by a recess depth in the clear areas,” as Claim 54 requires.

The Office Action asserts that Mitsui teaches “that (optical) transmission T of the attenuated PS layer decreases with decreasing wavelength λ , but that T increases with decreasing thickness of the attenuated PS layer, and that the amount of PS is nearly the same (approximately equal) or increases with decreasing thickness of the attenuated PS layer.” However, a careful reading of Mitsui reveals that Mitsui teaches changing the material composition *and* changing the film thickness (see, e.g., FIG. 5 of Mitsui) for fabricating a mask blank designed for one wavelength of light. The disclosure of Mitsui is focused on designing and fabricating mask blanks for use with one wavelength of light to provide a desired attenuation and phase shift.

Nowhere in Mitsui is there any teaching, suggestion, or motivation for taking a mask blank designed for use with light of a first wavelength, modifying the thicknesses of the attenuating and phase-shifting layer at the dark and clear areas to adapt the *same* mask blank for use with light of a second wavelength (where the second wavelength is smaller than the first wavelength). The Office Action even states that “Mitsui et al. do not specifically teach thinning of the attenuated PS layer on the attenuated PSM blank for a first wavelength of exposure light to adapt the blank for making an attenuated PSM usable at a second wavelength of exposure light that is different from the first wavelength.” It is improper to make the huge leap from that to stating that the invention of the present application is obvious. Such leap may only be accomplished in hindsight of the disclosure of the present application, which is improper.

The Office Action cites Tako and asserts that “Tako teaches a method for correcting characteristics of an attenuated phase shift mask Such characteristics to be corrected include (optical) transmittance and/or phase difference (phase shift, PS) The correction method includes removing portions of the transparent substrate to form a recess having a recess depth at the clear areas by controlled etching . . . of the transparent substrate 412 between adjacent regions having attenuated PS layer 414, as shown in Figures 12D and 12E” However, just as with Mitsui, Tako does not teach, suggest, or disclose taking a mask blank designed for use with light of a first wavelength, modifying the thickness of the attenuating and

phase-shifting layer at the dark areas and recessing the transparent layer at the clear areas to adapt the *same* mask blank for use with light of a *different* second wavelength (where the second wavelength is smaller than the first wavelength). A careful reading of Tako reveals that Tako merely focuses on adjusting a mask blank designed for a first wavelength for use with the *same* first wavelength. There is no mention in Mitsui or Tako of adapting a *same* mask blank for a *different and smaller* second wavelength.

Furthermore, there is no method of performing such adaptation of a *same* mask blank where the determining of the reduced thickness at the dark areas and the recess depth at the clear areas (for providing a predetermined phase shift and transmittance at a *different* second wavelength) is performed using the equations provided in Claim 54. There is no mention of such equations nor the use of such equations in a method of adapting a mask blank for use with a different second wavelength in any of the cited references, alone or in any combination.

The Office Action also cites Chen and Shiota, but these references are clearly not relevant to Claim 54. Neither Chen or Shiota teach “recessing the transparent layer by a recess depth in the clear areas,” as Claim 54 requires. Thus, Applicant respectfully submits that the invention of Claim 54 is not obvious in view of Chen or Shiota, alone or in combination with the other cited references.

Each and every element of the claim must be taught or suggested in the cited references to build a proper *prima facie* case of obviousness. No element or limitation of the claim can be ignored when establishing a *prima facie* case of obviousness (see MPEP 2143 above). Therefore, Applicant respectfully asserts that the invention of Claim 54 is not obvious in view of the cited references.

Because Claims 55-65 depend from Claim 54, Applicant respectfully submits that Claims 55-65 are patentable over the cited references because of their dependency from independent claim 54 for at least the same reasons discussed above regarding Claim 54.

Claims 66-67

The cited references do not disclose, teach, suggest, or motivate a “method of making an attenuating and phase-shifting mask for use in semiconductor manufacturing” beginning with

“obtaining a mask blank designed for use with light of a first wavelength” where “the mask blank is prefabricated and obtained from another company” and then “patterning and adapting the mask blank to be an adapted-patterned mask for use with light of a second wavelength” by “reducing the initial APS-layer thickness of the APS layer to a first APS-layer thickness” and by “recessing the transparent layer by a recess depth in the clear areas” so that “a predetermined transmittance and a predetermined phase shift are provided by light of the second wavelength passing through dark areas of the adapted-patterned mask relative to light of the second wavelength passing through clear areas of the adapted-patterned mask” where “the second wavelength is at least 30 nm smaller than the first wavelength,” as Claim 66 requires.

The Office Action cites Mitsui, alone and in combination with Takushima. The Office Action states (and Applicant agrees) that “Mitsui et al. do not specifically teach removing portions of the transparent substrate to form a recess at the clear areas or portions having a first recess depth.” Thus, Mitsui is clearly missing a teaching on the element of “recessing the transparent layer by a recess depth in the clear areas,” as Claim 66 requires.

The Office Action cites Tako and asserts that “Tako teaches a method for correcting characteristics of an attenuated phase shift mask Such characteristics to be corrected include (optical) transmittance and/or phase difference (phase shift, PS) The correction method includes removing portions of the transparent substrate to form a recess having a recess depth at the clear areas by controlled etching . . . of the transparent substrate 412 between adjacent regions having attenuated PS layer 414, as shown in Figures 12D and 12E” However, just as with Mitsui, Tako does not teach, suggest, or disclose taking a mask blank designed for use with light of a first wavelength (where the mask blank is *prefabricated and obtained from another company*), modifying the thickness of the attenuating and phase-shifting layer at the dark areas and recessing the transparent layer at the clear areas to adapt the *same* mask blank for use with light of a *different* second wavelength (where the second wavelength is *at least 30 nm smaller* than the first wavelength). A careful reading of Tako reveals that Tako merely focuses on adjusting a mask blank designed for a first wavelength for use with the *same* first wavelength. There is no mention in Mitsui or Tako of adapting a *same* mask blank for a *different and at least 30 nm smaller* second wavelength.

The Office Action also cites Chen and Shiota, but these references are clearly not relevant to Claim 66. Neither Chen or Shiota teach “recessing the transparent layer by a recess depth in the clear areas,” as Claim 66 requires. Thus, Applicant respectfully submits that the invention of Claim 66 is not obvious in view of Chen or Shiota, alone or in combination with the other cited references.

Each and every element of the claim must be taught or suggested in the cited references to build a proper *prima facie* case of obviousness. No element or limitation of the claim can be ignored when establishing a *prima facie* case of obviousness (see MPEP 2143 above). Therefore, Applicant respectfully asserts that the invention of Claim 66 is not obvious in view of the cited references.

Because Claim 67 depends from Claim 66, Applicant respectfully submits that Claim 67 is patentable over the cited references because of its dependency from independent claim 66 for at least the same reasons discussed above regarding Claim 66.

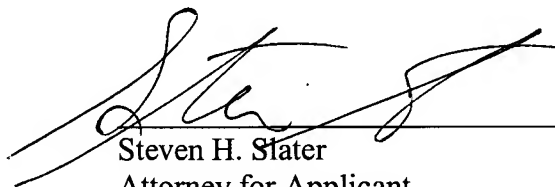
If the Patent Office endeavors to reject any of Claims 40-67 base on the cited references, Applicant respectfully requests that the Patent Office please point out with particularity how and where the cited references, either singularly or combined, discloses *all* of the required limitations of the claims. In the absence of a *prima facie* showing of obviousness by the Patent Office, Applicant submits that Claims 40-67 should be allowed.

(8) In view of the above, Applicant respectfully submits that the application is in condition for allowance and requests that the case be passed to issuance. If the Examiner should have any questions, Applicant requests that the Examiner contact Applicant's attorney at the address below. No fee is believed to be due at this time. In the event that there are any fees due herein to keep the application pending, other than an issue fee, please charge the same, or credit any overpayment, to Deposit Account No. 50-1065.

Respectfully submitted,

22 Feb. 2006

Date

A handwritten signature in black ink, appearing to read "Steven H. Slater", is written over a horizontal line.

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